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CLAIMS

1. A valve spring retainer, comprising:
 - a titanium alloy body portion including an opening therethrough for receiving a valve stem, and at least one step disposed about the opening;
 - a tungsten carbide layer bonded to the titanium alloy on the step to at least in part define a wear resistant spring seat for engaging an end of a spring.
2. The valve spring retainer of claim 1 wherein the at least one step comprises a first step disposed about the opening at a first elevation and a second step disposed about the first step at a second elevation, and wherein a first tungsten carbide layer is bonded to the titanium alloy of the first step to define a first wear resistant spring seat and a second tungsten carbide layer is bonded to the titanium alloy of the second step to define a second wear resistant spring seat.
3. The valve spring retainer of claim 1 wherein the tungsten carbide layer is surrounded by a titanium alloy lip of the body portion for reducing damage to an outer edge of the tungsten carbide layer during contact by an end of a spring.
4. The valve spring retainer of claim 1 wherein the titanium alloy comprises Ti 17.
5. The valve spring retainer of claim 4 wherein the tungsten carbide layer is bonded to the titanium alloy of the step via an HVOF coating process.
6. The valve spring retainer of claim 5 wherein the tungsten carbide layer is formed by HVOF application of Sulzer 5803 tungsten carbide powder.

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7. The valve spring retainer of claim 1 wherein the tungsten carbide layer is applied in an undercut on the step.
8. The valve spring retainer of claim 7 wherein the tungsten carbide layer has a thickness of at least about 0.001 inches.
9. The valve spring retainer of claim 8 wherein the thickness of the tungsten carbide layer is at least about 0.004 inches.
10. A valve spring retainer assembly, comprising:
at least one valve spring positioned with one end against the wear resistant spring seat of the valve spring retainer of claim 1.
11. A high performance engine, comprising:
at least one valve associated with the valve spring retainer assembly of claim 10.
12. A valve spring retainer, comprising:
a body portion having an opening therethrough for receiving a valve stem, the body portion including at least one step disposed about the opening, the step being of a first material;
a coating of a second material bonded to the first material on the step to define, at least in part, a spring seat for engaging an end of a spring;
wherein the second material is more wear resistant than the first material, and the second material is a tungsten carbide material.

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13. The valve spring retainer of claim 12 wherein the body portion is formed by a unitary body in combination with a shim member adjacent the unitary body, the shim member in part defines the step.
14. The valve spring retainer of claim 13 wherein the shim is of the first material and the unitary body is of a third material.
15. The valve spring retainer of claim 12 wherein the body portion, including the step, is a unitary member of the first material.
16. The valve spring retainer of claim 12 wherein the second material is applied in an undercut on the step.
17. The valve spring retainer of claim 16 wherein a surface defining the undercut is roughened to facilitate bonding with the second material.
18. The valve spring retainer of claim 12 wherein the second material has a thickness of at least about 0.001 inches.
19. The valve spring retainer of claim 12 wherein the second material has a thickness of at least about 0.004 inches.
20. A method of manufacturing a valve spring retainer, comprising:
 - (a) machining a titanium alloy material to produce a retainer body having an opening therethrough for receiving a valve stem, and at least one step disposed about the opening;
 - (b) roughening a portion of the step;

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(c) applying a tungsten carbide coating to the roughened portion of the step via an HVOF process;

(d) smoothing the tungsten carbide coating to provide a wear resistant spring seat surface on the step.

21. The method of claim 20 wherein the retainer body produced in the machining of step (b) includes a central collet through which the opening extends, and during step (c) the central collet is covered.

22. The method of claim 20 wherein in step (a) an undercut is machined in the step, in step (b) the undercut is roughened and in step (c) the tungsten carbide coating is applied in the undercut.

23. The method of claim 20 wherein in step (d) the tungsten carbide coating is smoothed to an Ra surface finish of 6 microns or less.

24. The method of claim 23 wherein the smoothing of step (d) includes a diamond grinding operation.

25. The method of claim 23 wherein the smoothing of step (d) includes a CNC lathe machining operation.

26. The method of claim 20 wherein during step (c) the retainer body is spun.

27. A valve spring retainer, comprising:

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a body portion having an opening therethrough for receiving a valve stem, the body portion including at least one step disposed about the opening, the step being of a first material;

a coating of a second material bonded to the first material on the step to define, at least in part, a spring seat for engaging an end of a spring;

wherein the second material is more wear resistant than the first material, and the body portion includes a lip that extends around the coating of the second material to reduce damage to an outer edge of the coating of the second material during contact by an end of a spring.

28. The valve spring retainer of claim 27 wherein the second material has a thickness of at least about 0.001 inches.

29. The valve spring retainer of claim 28 wherein the second material has a thickness of at least about 0.004 inches.

30. The valve spring retainer of claim 27 wherein the second material is applied in an undercut on the step.

31. The valve spring retainer of claim 27 wherein a surface defining the undercut is roughened to facilitate bonding with the second material.